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Development of PISA Type Mathematics Problems Using the Context of Palembang City Tourism

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ABSTRACT

This study aims to produce valid and practical mathematical problems using Palembang City tourism contexts. The research method used was a design research method with a development study type. The research consists of the main stages consisting of preparation and design while the formative evaluation consists of self-evaluation, expert review, one-to-one, and field tests. This study resulted in 7 units of valid and practical questions and there were 12 questions that had been developed. The valid criteria in this question are seen from the aspects of content, construct, and language, while the practical aspect is seen from the results of small groups where the questions are with a context that is recognized by students. Furthermore, the teacher has a question reference to use in preparation for the AKM (Minimum Competency Assessment).

Keywords: Education, PISA, AKM.

1. INTRODUCTION

The Program for International Student Assessment (PISA) is an organization that has the task and purpose of assessing the ability of students around the world and PISA is part of the Organization for Economic Cooperation and Development (OECD). PISA assesses students and the world with the age criteria of 15 years on knowledge and skills in reading, mathematics and real-life science [1]. PISA is held every three years. Indonesia is one of the countries that participating in the OECD program to assess the ability of Indonesian students who are 15 years old. Since 2000 to 2018, Indonesia has continued to follow the assessment.

As a result, the ability of Indonesian students is low compared to neighboring countries such as Singapore. In line with research conducted by [2] states that students' mathematical literacy skills are low based on the results of PISA in 2018. The low ability of Indonesian students is seen in literacy skills [3,4]. According to [5], Indonesian students are not familiar with contextual questions such as the PISA questions, which are mainly high-level questions, both in the learning process and in evaluation. Meanwhile, according to [6], Indonesian students are generally less trained in solving questions with characteristics such as TIMS and PISA questions.

This is what underlies the 2013 curriculum, where previously the KTSP curriculum was born. So far, the

assessment of the achievement of Indonesian students is seen in the results of the National exam for students of class IX of Junior High School, or students of class XII of High School. Regarding this, the Minister of Education and Culture, Mr. Nadiem Makarim, said that the National Examination was abolished and replaced with a Minimum Competency Assessment (AKM). The presence of AKM replaces the National Examination based on the results of the Indonesian PISA which has not improved, this AKM assessment measures the achievement of cognitive literacy and numeracy learning outcomes [7]. The questions applied to the AKM are adopted from PISA questions, so teachers, lecturers or researchers must prepare teaching materials or questions with the character of PISA questions.

Based on the background above, researcher wants to make PISA questions using a context. Learning uses the context of making students find meaningful relationships between abstract ideas and practical applications in real contexts [8]. Whereas, the use of local contexts can help students understand the phenomenon of mathematics from the perspective of their own life experiences [9]. Furthermore, [10,11] stated that mathematical literacy is the ability of individuals to formulate, apply, and interpret mathematics in various contexts, not only about the context in everyday life. On the other hands, the use of context in learning is very important because context can present mathematical problems in abstract form to

representations that are easily understood by students [12].

Researchers made PISA questions using the context of Palembang tours hoping that the questions developed could be used by teachers to give students to help students get used to solving high-level questions. As stated by [13] that Indonesian students are not used to solving PISA questions. Based on the description above, the researcher aims to produce PISA type math problems using a valid and practical Palembang tourism context.

2. RESEARCH METHOD

The method in this study uses a design research method with the type of development study. This research consists of the main stages, namely preliminary and formative evaluation. The preliminary stage consists of preparation in the form of analysis and design, while the formative evaluation stage consists of self-evaluation, expert reviews, one-to-one, small group, and field tests [14,15].

The following is a formative evaluation design flow.

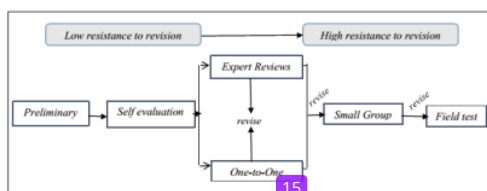


Figure 1 Formative evaluation design

The subject of this research is class IX students of SMP Negeri 1 Palembang, this research was held during the odd semester of 2020-2021 teaching. The research design at the preliminary stage made preparations, in the form of analysis and design. The analysis stage is conducting an analysis of the curriculum at the school as the location of the object of research and the teacher's handbook. Another preparation is to arrange the research time for the teachers and the school. Furthermore, the research conducted the design of lattices and mathematical problems of the PISA type in the context of Palembang tourism.

The Formative Evaluation stage is Self-Evaluation, at this stage, a self-assessment has been made by the researcher on the design results of the PISA model questions. Then Expert Review, at this stage the question designs that have been made by researchers are then evaluated by experts where the products that have been made are seen, assessed, and evaluated. The validity test carried out is the content, construct, and language validity test. The responses and suggestions from the validator are written on the validation sheet which is used to revise the question design and to state that the learning tool is valid.

As well as One-to-one, in this one-to-one stage, the researcher asked 3 students and the comments obtained would be used to revise the PISA model questions that had been made by the researcher. In the Small Group stage, the results of revisions and expert reviews and one-to-one comments are called prototype 2 which is used as the basis for designing questions at a later stage. Small group was tested with 6 students. This question design was tested in a small group where the students were asked to provide responses to the PISA model questions being tested.

Based on the test results and student responses, the questions were revised and improved again. The results of the revision of the questions from the small group stage are called prototype 3 which will be tested at the field test stage. The results of prototype 3 were tested on a field test at SMP Negeri 1 Palembang. The field test stage aims to obtain valid and practical PISA-type math problems and to find out the potential effects of the developed questions on students' mathematical literacy. The data collection procedure is the document used in the self-evaluation stage is the 2013 junior high school curriculum, the PISA framework, and the design of the PISA test using the characteristics of the construct, content, and language obtained by the initial prototype. Walkthrough is carried out with experts at the expert review stage. The results of the walkthrough are used to revise the initial prototype which is carried out in conjunction with one-to-one to get the second prototype.

The test was given a PISA model of math problems that had been developed previously for 3 high, medium, and low ability students in junior high school class IX. Interviews were conducted with students when working on PISA model questions at the one-to-one stage. The results of the interview will be used as revision material on the initial prototype and see the clarity of the questions. Observations were carried out to students when working on PISA model math problems at the one-to-one stage where observations were made to find out students' difficulties in working on questions and to know the practicality of the questions.

Data analysis techniques is document analysis where researchers analyze the first prototype set of questions that have been produced to find out whether the developed questions are in accordance with the PISA framework, the 2013 junior high school curriculum, and students' mathematical literacy skills. Walk-through analysis, researchers conducted an analysis by revising based on walk-throughs so that the questions made by the researchers obtained valid questions.

Interview analysis by observing the difficulties and findings of student work where these results are used to revise the questions made by researchers. The observational analysis is also used to see students' obstacles in working on the PISA model math problems that have been developed in order to revise the questions

that have been made by researchers. Then the test questions have been developed to see the validity and practicality of the questions developed.

3. RESULTS AND DISCUSSION

The process of developing questions in this research uses the research design research method with the type of development study. The development of PISA type math problems has carried out several previous stages, namely preparation in the form of analysis and design.

The preliminary stage consists of analysis consisting of student analysis, curriculum analysis and analysis of PISA questions. At this stage of the analysis, the researchers used students of SMP N 1 Palembang class IX, then the researchers identified students who would play a role in the one-to-one, small group and field tests recommended by the mathematics teacher. Each trial group in the one-to-one stage uses 3 students with high, medium, and low criteria, while the small group uses 2 groups where each group consists of 3 students with different criteria, namely high, medium, and low. At the stage of the field test, the students were 1 class with a total of 30 students with heterogeneous abilities with different students from the one-to-one and small group stages. The design stages resulted in 7 contexts with details of 2 questions with the context of a game of concentration, 1 question with the context of Palembang traditional dance, 3 questions with the context of Palembang bridge (namely, Ampera, Musi 2, Musi 4), 1 question with the context of Palembang Songket pattern, 2 questions with the context of Jakabaring Sport Center, 2 questions with the cultural context of Palembang, and 1 question with the context of traditional house of Palembang.

Next is a self-evaluation where the researcher reviews the prototype that has previously been designed, and the researcher asks for input from one of the teachers of SMP N 1 Palembang to see whether the language used makes students confused or students think differently. The results of a review of teachers of SMP N 1 Palembang, that the discussion used was good, did not cause double meaning, but some words were corrected which made it easier for students to understand, then this result was called prototype 1.

In the next stage, to get a prototype, 2 researchers gave it to 2 experts, namely Dr. Somakim, Pd and Dr. Bambang Riyanto, M.Pd at the stage of expert review and one to one. The researcher gave prototype 1 to the expert, namely Dr. Somakim, M.Pd and Dr. Bambang Riyanto, M.Pd to validate the content, construct, and discussion aspects.

Regarding the validation results from experts that the aspect of the content of the questions developed needs to be improved in terms of the level of the questions developed, in the aspect of the construction of some

images/contexts on the questions developed must be clearer so as not to make students confused and have difficulty reading images that are not clear. Meanwhile, in the language aspect, according to the two experts, there are still ambiguous words. From the results of the validation by the expert, the researcher made improvements, there were questions that were corrected by the expert.

The following is one of the contexts that was improved:

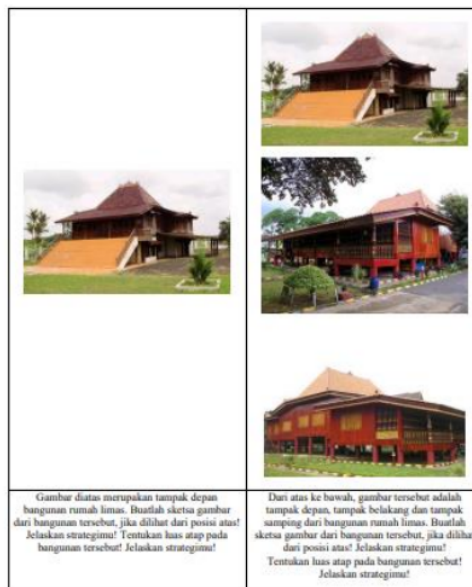


Figure 2 Left before revision and right after revision

During the validation process to experts, researchers carried out one-to-one stages. This stage uses 3 students who have different abilities, namely high, medium, and low. The results of this one-to-one stage are that commenting is quite good on the questions developed, but there are some questions that make students have difficulty, namely in the form of questions with pictures. In this regard, the researcher draws conclusions to make improvements to the context of the questions that are considered unclear. From the results of the validation of both experts and students, prototype 2. Furthermore, in the small group stage, researchers have obtained a second prototype that is valid and assessed by experts and students. The researcher gave prototype 2 to 2 groups of students, with each group consisting of 3 students with different criteria, namely high, medium, and low. This small group stage aims to see if this prototype is practical or can be used or not, and this stage sees whether students understand the meaning of the questions given either in information, pictures or numbers. When students start working on questions

either individually or in groups, the researcher sees students having a debate about which method/strategy is more appropriate to use in answering the questions provided related to this, the researcher sees that it is good and good about the discussions that students have. So that the researchers did not find such a big problem for students in understanding the questions that had been developed so that all the questions developed were not revised and could be used at the next stage. The next stage is a field test using prototype 3 which has been practically seen from the small group stage.

From the results of testing prototypes to experts, one-to-one students and small group students, PISA-type math problems using the Palembang contexts were valid and practical. The following are examples of questions that have been developed, valid and practical:

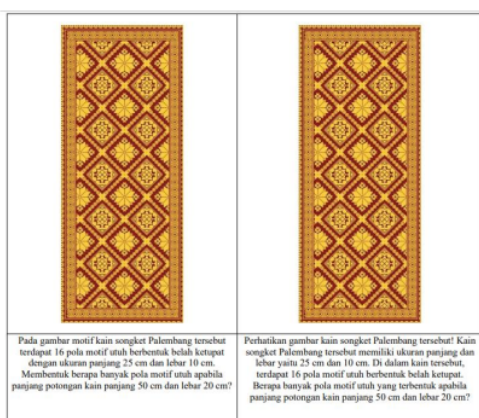


Figure 3 Example of Palembang context questions

4. CONCLUSION

This study resulted in a set of PISA-type math problems using the context of Palembang tourism, consisting of 7 units with a distribution of 12 questions with valid and practical contexts. The valid criteria in this question are seen in terms of content (questions according to the PISA mathematical literacy domain for content, context, and processability), constructs (questions according to the characteristics of PISA level questions and the abilities of grade IX students), and language (questions using a language that is according to EYD and can be understood by students) at the expert reviews and one-to-one stages. While the practicality criteria of the questions are seen from the results of the small group where the questions with the context recognized by the students can be understood by students and applied in learning.

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